

On the Verge of IMERG Version 07

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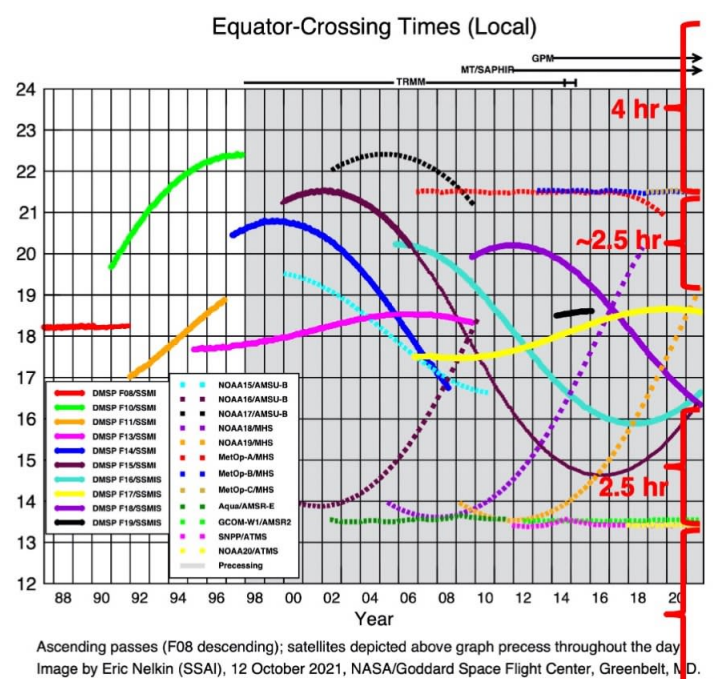
The GPM Constellation

The Current GPM constellation includes

- 5 passive microwave (PMW) imagers
- 6 PMW sounders (but SAPHIR ending)
- PMW input as precip estimates
- GPROF (most PMW) + PRPS (SAPHIR)
- PERSIANN-CCS (GEO IR)
- CORRA (combined PMW-Ku radar)
- GPCP SG (monthly satellite-gauge)

Presently the interval between observations is < 3 hr >90% of the time, globally

- there are still significant gaps in coverage by the polar-orbit satellites
- the precessing satellites only occasionally fill these gaps
- the constellation is evolving
- the next challenge is coping with short-lived smallsats



Quick Description of IMERG

The Integrated Multi-satellite Retrievals for GPM (IMERG) is a single integrated code system for near-real and post-real time

- “Early” – 4 hr (flash flooding)
- “Late” – 14 hr (crop forecasting)
- “Final” – 3 months (research)
- half-hourly and monthly (Final only)
- 0.1° global CED grid
- morphed precip, 60° N-S in V05, 90° N-S in V06
- all 3 (Early, Late, Final) cover June 2000 to the (delayed) present

Combined product (calibrator) adjusted to GPCP V2.3 seasonal climatology zonally for reasonable bias

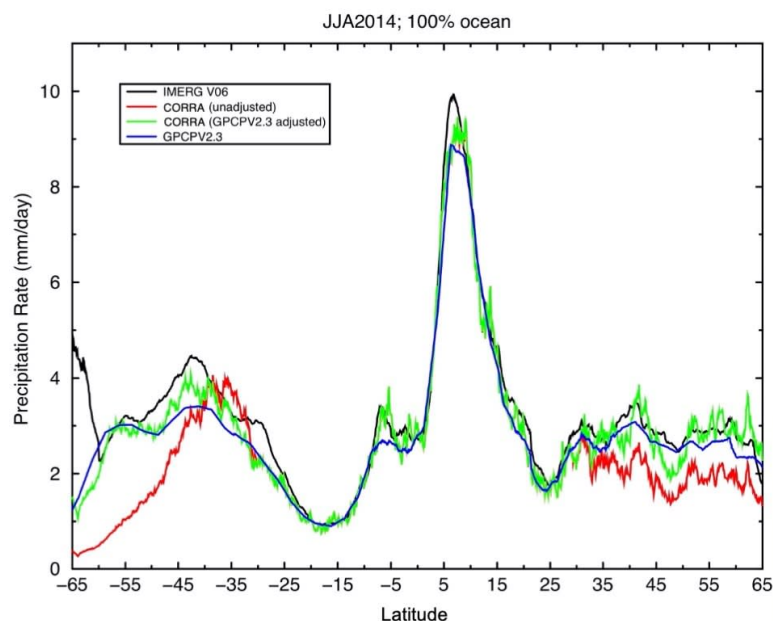
Over land GPCP adjustment provides a first cut at the adjustment to gauges used in the Final

The calibration sequence is

- CORRA climatologically calibrated to GPCP over ocean outside 30°N-S
- GMI calibrated to monthly CORRA
- GPM constellation climatologically calibrated to GMI

Adjustments working roughly as intended

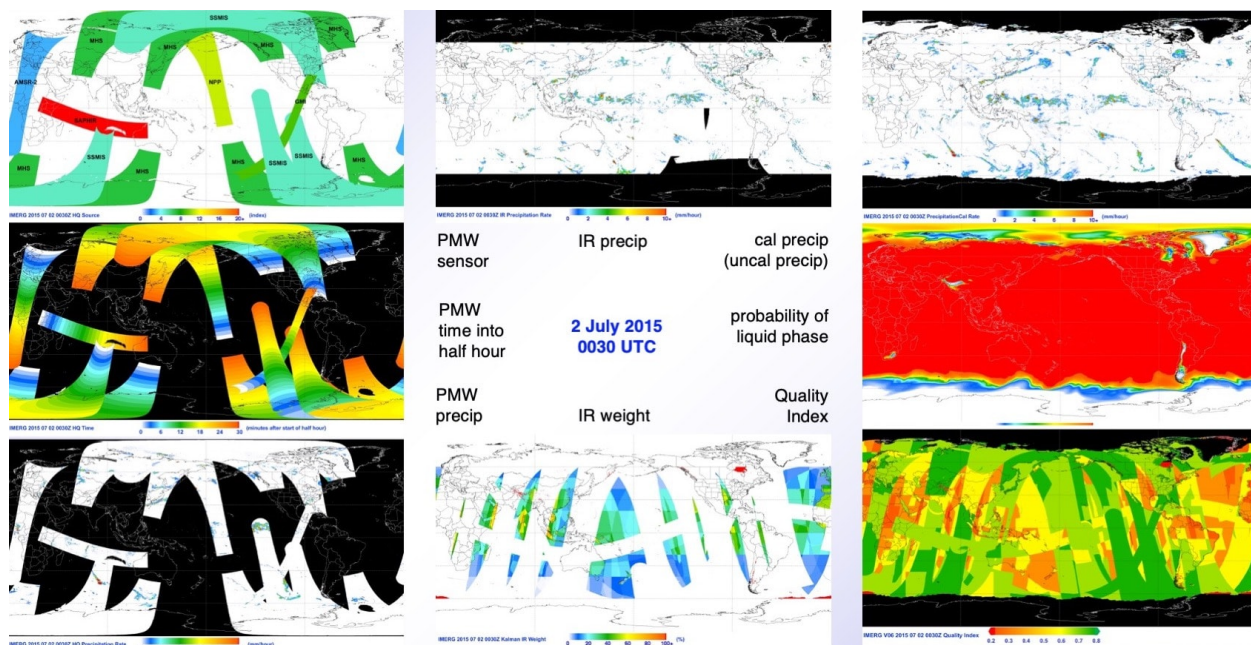
- CORRA is low at higher latitudes
- adjustments in Southern Ocean are large and need analysis
- IMERG subsetting to coincidence with CORRA is much closer to (adjusted) CORRA



D. Bolvin (SSAI; GSFC)

Data fields in IMERG

V06 Half-hourly data file (Early, Late, Final)	
1	[multi-sat.] precipitationCal
2	[multi-sat.] precipitationUncal
3	[multi-sat. precip] randomError
4	[PMW] HQprecipitation
5	[PMW] HQprecipSource [identifier]
6	[PMW] HQobservationTime
7	IRprecipitation
8	IRkalmanFilterWeight
9	[phase] probabilityLiquidPrecipitation
10	precipitationQualityIndex
V06 Monthly data file (Final)	
1	[sat.-gauge] precipitation
2	[sat.-gauge precip] randomError
3	GaugeRelativeWeighting
4	probabilityLiquidPrecipitation [phase]
5	precipitationQualityIndex



IMERG Upgrades for Version 07

Input data issues

New IR quality assurance

- addresses multiple issues, particularly episodic GOES-W cooling issues
- likely requires on-going tuning
- pressed into service in V06

Update IR precipitation algorithm

- PERSIANN Dynamic Infrared–Rain Rate (PDIR-Now)
- led by Phu Nguyen, U.C. Irvine
- conversion to PPS-compatible language code led by Dan Braithwaite
- based on PERSIANN-CCS with another threshold and a new machine-learning approach

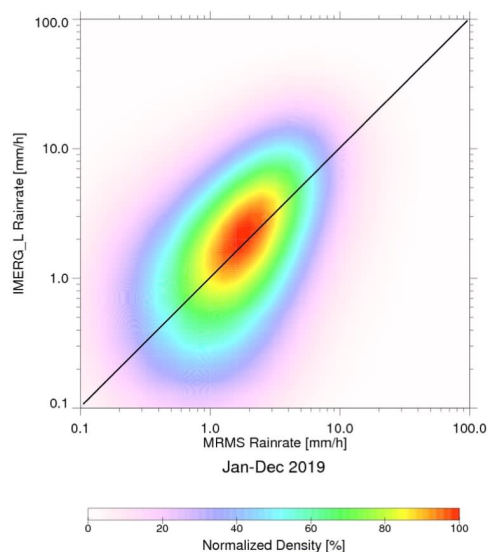
Assess the degree to which GPROF MW estimates can be used over snowy/icy surfaces

- "warm" snowfall cases seem to have skill
- sea ice cases seem to have no skill
- gaps will still exist in coldest regions

Multi-satellite issues

Address IMERG satellite bias

- varies by weather regime
- but, tends to overestimate mean precipitation compared to other merged products
- subject of (very) active, tedious investigation focused on the CORRA-PMW calibration
- example over CONUS of IMERG_L vs. MRMS



GPM GV Office

MW and IR precipitation limits raised to 200 mm/hour across the code

- currently 120 mm/hour and 50 mm/hour, respectively

Compute precipitation motion vectors using multiple numerical analysis fields

- improve behavior near orography
- Precipitation (PRECTOT) → Total Precipitable Liquid Water (TQL) → Total Precipitable Water Vapor (TQV)
- V06 was just TQV

Change some variable names

- intended to reduce confusion
- yes, this will break some current code; sorry!
- SHARPEN changes meaning of IRWeight

	V07 Half-hourly data file (Early, Late, Final)
1	[multi-sat.] precipitation Gal
2	[multi-sat.] precipitationUncal
3	[multi-sat. precip] randomError
4	[PMW] HQMW precipitation
5	[PMW] HQMW precipSource [identifier]
6	[PMW] HQMW observationTime
7	IRprecipitation
8	IR influence kalmanFilter Weight
9	[phase] probabilityLiquidPrecipitation
10	precipitationQualityIndex
	V07 Monthly data file (Final)
1	[sat.-gauge] precipitation
2	[sat.-gauge precip] randomError
3	GaugeRelativeWeighting
4	probabilityLiquidPrecipitation [phase]
5	precipitationQualityIndex

Modify selection of the (single) satellite used when there are multiple PMW estimates for a given time/grid box

- Yalei You's work showed that conical "imagers" out-perform cross-track "sounders" over ocean

Run Kalman Filter on PMW overpasses

- even with SHARPEN (see top right box), using PMW overpasses "as is" causes ripples in the animations
- skill measures are maintained or modestly improved

Address averaging effects on PDF of precipitation introduced by Kalman Filter

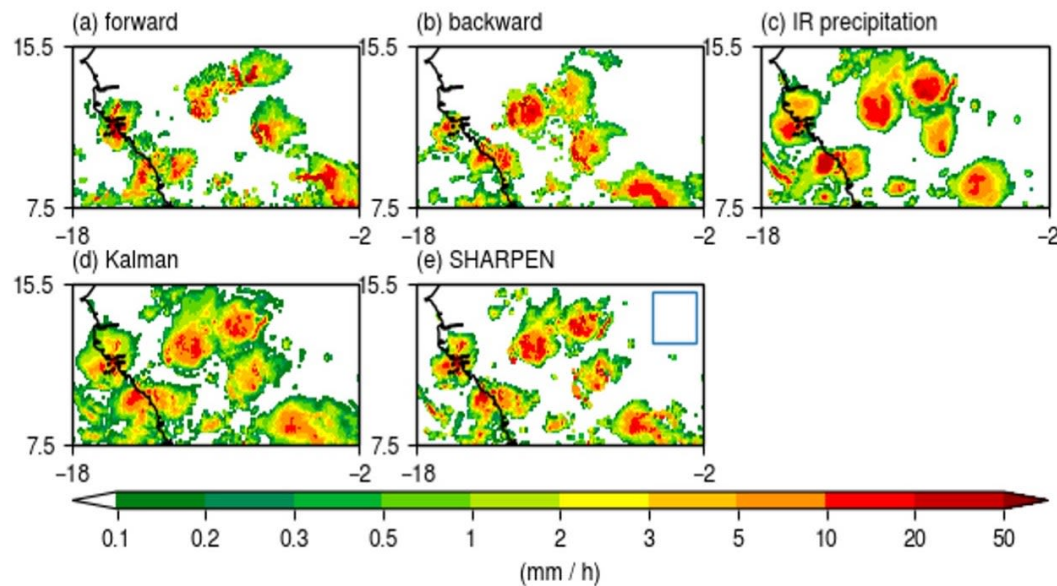
- Ed Zipser and Mani Rajagopal showed increased occurrence of rain and reduced maximum values in morphed values (*JHM*, 2021, doi:10.1175/JHM-D-20-0226.1)
- Scheme for Histogram Adjustment with Ranked Precipitation Estimates in the Neighborhood (SHARPEN) (*JHM*, 2021, doi:10.1175/JHM-D-20-0225.1)
- see the top right panel for more information and the poster
<https://agu.confex.com/agu/fm21/meetingapp.cgi/Paper/829783>

Quick SHARPEN Example

Undo distortion of PDF when averaging precipitation during morphing in Kalman filter

Use local quantile mapping from morphed to input PDFs

Example over West Africa for 00:00-00:30 UTC, 1 July 2018. The blue square in (e) shows the size of the “local” 25x25 template.



J. Tan (UMBC)

The datasets input to the Kalman filter have similar PDFs (top row)

The Kalman-filtered result (d) has larger coverage, lower maximum rates because it's a weighted average

The SHARPEN'ed precipitation PDF (e) is closer to the input precipitation PDFs

For more information, see <https://agu.confex.com/agu/fm21/meetingapp.cgi/Paper/829783>

IMERG V07 Schedule

TMPA research and real-time products ended with end of 2019

- the products are still getting a lot of use, but users are encouraged to move to IMERG

The Version 07 release is happening later than originally planned

- 6 December: radar reprocessings started
- 1 February: Combined and GPROF reprocessings start
- 1 May (notional): IMERG reprocessing starts, but
- 1 December: IMERG Early and Late Runs must shift from V06 to V07 hybrid Combined near-real-time input
- November: last month of V06 IMERG Final products

